Tips for success in the German pick & place market
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Erasable drives lead the optical-storage sweepstakes
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Low-end workstations scrap for the commercial market
PAGE 87

A CAHNERS PUBLICATION

Electronic Business®

FOR THE MANAGEMENT TEAM IN ELECTRONICS, COMPUTER, AND SYSTEMS COMPANIES WORLDWIDE

APRIL 27, 1992

Stuck in heavy metal and silicon?

Learn how Irwin Pfister helps Schlumberger differentiate its ATE products with software. It's a tough balancing act, but it could be the success strategy for the '90s.

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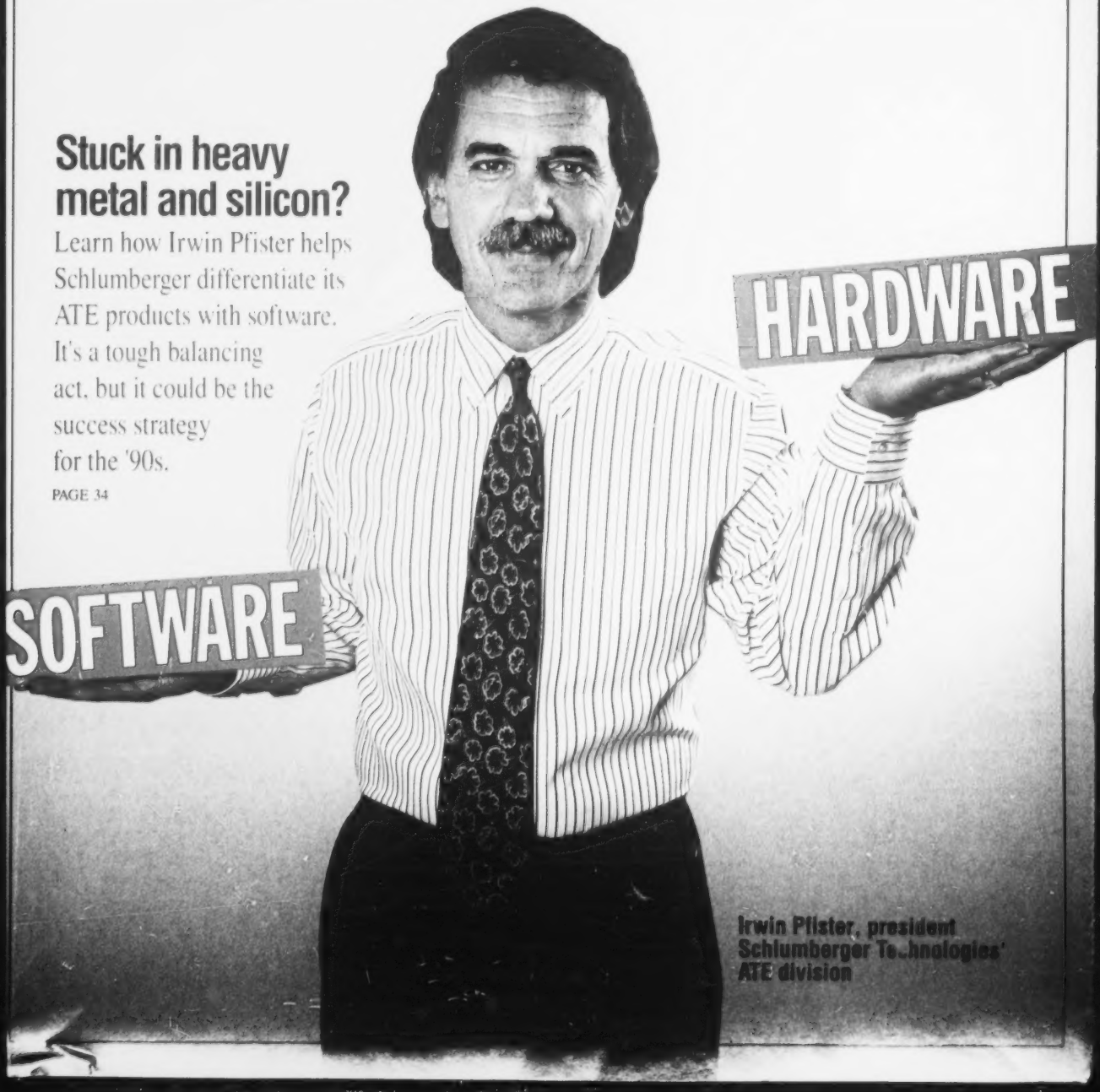
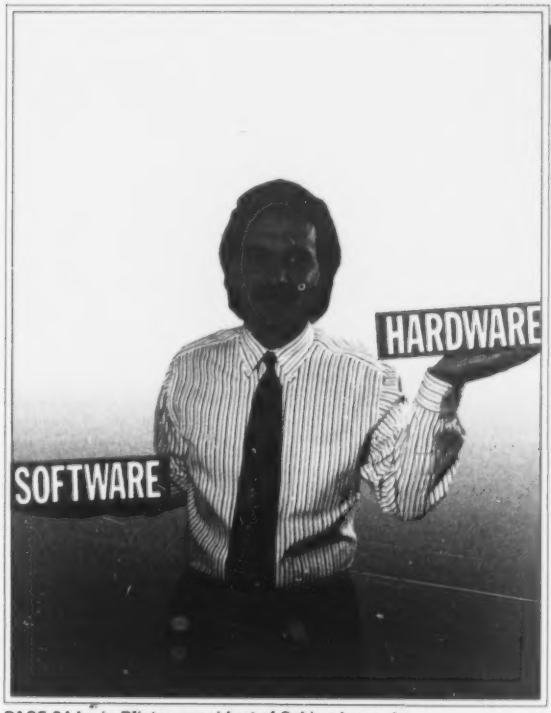


Irwin Pfister, president Schlumberger Technologies' ATE division

Electronic Business

VOLUME 18, NUMBER 7 — FOR THE MANAGEMENT TEAM IN ELECTRONICS, COMPUTER, AND SYSTEMS COMPANIES-WORLDWIDE — APRIL 27, 1992



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Schlumberger Technologies' IC test equipment division—in many ways, the ultimate hardware business—has invested heavily in proprietary software as the best way to set its products apart from the competition. While the company's software has climbed from 2% of total sales to about 20%, some wonder how many customers will pay for the products they once got for free

Cover photo by Liane Enkelis

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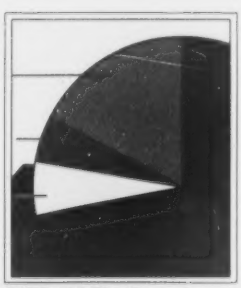

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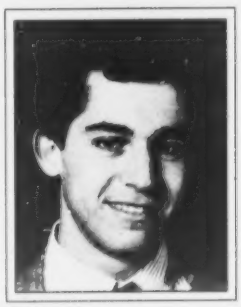
Electronics 1995: The hard and the soft of it

If you're not convinced that electronics manufacturers are seeing their corporate futures in software, consider this: By 1995, Schlumberger Technologies predicts that only 30% of its engineering staff will be working in hardware while 70% will be in software. Just two years ago, the hardware-to-software engineering ratio was 60:40 in favor of hardware.



Senior editor Peter Burrows

Schlumberger's automated test equipment (ATE) operation provides a fascinating window into the hardware-versus-software debate: While ATE is about as hardware-oriented a field as there is, the smart money is clearly on software innovation. Senior editor Peter Burrows reports that Schlumberger invested $3 million last year in its Austin-based computer science laboratory, where software engineers use the latest supercomputer to employ technology they believe will differentiate Schlumberger from the rest of the ATE world. Some of that technology focuses on an improved interface for equipment users, some on the engineering of software development itself. Writing software, after all, imposes new and stern demands for quality and reliability.

As Schlumberger has learned, and as other companies would be wise to remember, new manufacturing technology isn't the only challenge in making software development pay. Salespeople must learn to treat software as a primary asset, not as an add-on incentive to boost hardware sales. Manufacturers must choose with care the software they sell, and they must decide how to price systems that incorporate their new software in a way that reflects added value without turning off old customers.

Meanwhile, are we to consign all hardware manufacturing to a downward spiral of commodity pricing that puts U.S. players out of the game? Not necessarily, reports West Coast managing editor Hugh Willett. U.S. executives are finding there's room to compete even in the low-end chip, board, and PC markets. The trick, they say, is to increase efficiency in operations and manufacturing while differentiating the product in terms of power, service and support, and interconnectivity. Alas, it's mostly the larger companies that have the resources to compete in the large-scale manufacture of "commodity" chips and systems while making heavy R&D investment in high-end products.

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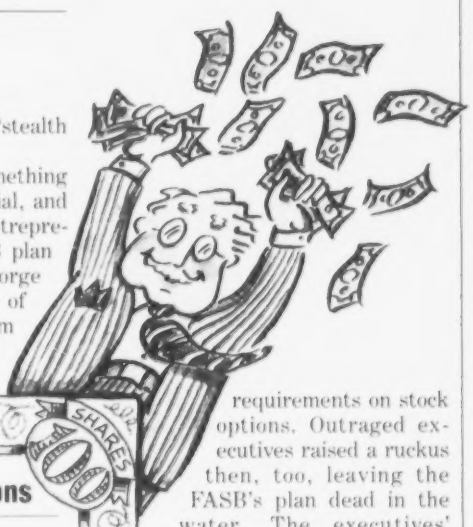
BPA ABP

COMPENSATION

End of the stock-options party?



THE FINANCIAL Accounting Standards Board (FASB) is again proposing that the estimated value of unexercised stock options be treated as an operating expense. High-tech start-ups claim the proposal is a disaster: Not only will it discourage use of stock options to entice employees away from larger corporations, but treating stock options as an expense instead of as a potential tax deduction will hit everyone's bottom line. The FASB plan, S1198, is now in bill form and in Congressional committee.

Under current accounting standards, cash salaries are deducted from company earnings on the earnings statement and claimed as a tax deduction. When an employee exercises a stock option, the company does not show an expense on its statement but still deducts the expense. Stock-option plans currently are approved by a vote of stockholders and reported in footnotes of financial reports.

The proposal comes amid escalating sound and fury over excessive executive compensation, in which stock-option plans play a large part. "There is no other form of CEO pay that is a deduction on a corporations's tax return but not an expense on the corporate books," says Sen. Carl Levin (D-Mich.), who has held two hearings on executive compensation. "That's why I call it 'stealth compensation.' "

High-tech CEOs call it something else, such as important, crucial, and essential to Silicon Valley's entrepreneurial culture. If the FASB plan were implemented, says George Sollman, president and CEO of San Jose-based Centigram Communications Corp., small and midsize companies would have to abandon or significantly cut the stock options they use to entice employees away from larger corporations that can pay higher salaries. Silicon Valley would become Death Valley, according to the proposal's critics. "The first employees at Centigram came from established corporations such as IBM, Xerox, and Rolm," Sollman told the Senate Subcommittee on Oversight of Government Management. "Without stock options, we could not have attracted those key people."

High-tech companies tend to offer stock options to an unusually large number of employees. All 240 employees at Centigram, for example, are eligible for stock options. "So a much higher percentage of [Centigram's] total compensation package would be affected by the new standard," says Sollman.

Actually, the proposal is a clone of the FASB's 1986 attempt to impose the same reporting accounting requirements on stock options. Outraged executives raised a ruckus then, too, leaving the FASB's plan dead in the water. The executives' cause was aided by an American Electronics Association survey of 12 companies that found the companies' reportable profits would have been cut by an average of 43.5%.

What wasn't happening in 1986, however, was the level of protest that is presently being raised by John Q. Public. Given the recession, unemployment, and election-year politics, the proposal now stands a better chance of being adopted. Furthermore, a Senate source says Levin's position is being supported all across the business community. So no matter how just the electronics and computer industries believe their cause to be, they've got some hard travelling ahead.

—Willie Schatz in Washington, D.C.

Why corporations like executive stock options

(Option: 10,000 shares at $15 per share)

	When granted	When vested	When exercised
Market price	$15	$25	$35
Expense to corporation	$0	$0	$0
Benefit to corporation	$0	$0	$150,000 Equity contribution $200,000 Tax deduction

Under current accounting practices, offering stock options doesn't cost companies anything, and they add benefit when exercised. The new FASB plan would change that.

INTERNATIONAL

Slow Japanese market wallops U.S. imports

TOKYO'S free-falling stock market signals rough times ahead for Japanese companies, many of which have responded by cutting back on new products and suppliers. That's bad news for U.S. electronics exporters, whose sales in Japan have fallen even faster than that nation's shipments of electronics goods.

Japan's downturn hits U.S. suppliers hardest

Japanese shipments	Nov. 1991 (% change from year ago)	Nov. 1991 (% change from previous month)
Integrated circuits	4.4%	5.0%
Computers and peripherals	-5.8%	7.5%
U.S. imports to Japan		
Integrated circuits	1.2%	-13.8%
Computers and peripherals	-7.7%	1.9%

Source: MITI

Last month, the Nikkei stock average slipped below 20,000 for the first time in more than five years. The slump reportedly has dampened lending by the nation's banks, which are heavily invested in the stock market. Although the economy's downturn is relatively modest—about .05% during the fourth quarter of 1991—uncertainty about the next few quarters has some managers visibly nervous. "The Japanese market started to drop only in October, so it hasn't reached bottom yet," says Kunihiro Yakuo, general manager of the microproducts division of Dai Nippon Printing Co. in Tokyo.

With sales, profits, and capital spending on the skids, everyone in Japan is hurting. Newcomers and outsiders, however, seem to be getting the worst of it. The hunker-down mentality means less willingness to take chances on new suppliers, fewer new product introductions (and hence fewer opportunities for new imported components), and more in-house production to keep workers busy. In addition, falling earnings mean new efforts to squeeze price concessions from suppliers and to shift production to higher value-added goods. "We don't think things will pick up for six months to a year at best," warns Katsunori Kubo, manager of corporate planning at wafer maker Shin-Etsu Handotai Co. in Tokyo.

All of that translates to fewer design-in programs that U.S. chip makers had hoped would boost sales. Although Japan's Ministry of International Trade and Industry (MITI) still pressures Japanese companies to do more, the cutback in new products will inevitably take a heavy toll. "[Japanese companies] are prioritizing foreign projects, but volume for design-in is much less," notes Takashi Takagaki, senior manager of Advanced Micro Devices (AMD) Japan's customer service center in Tokyo. Rather than touting its technology, Sunnyvale, Calif.-based AMD is working to maintain its Japanese sales by increased emphasis on quality, support services, and technical support.

Semiconductors and computers, each running more than $100 million a month, are by far the biggest categories of imports from the United States, followed by disk drives at about $35 million a month; all other categories run less than $15 million a month. Some of these smaller markets saw big percentage increases despite the general slowdown, however. Imports of color TVs from Japanese plants in the U.S. surged ninefold in November 1991 over 1990, to $5 million, while printed circuit boards climbed 7% to $12 million. Imports of printers jumped 46%, to $13 million.

Low-cost electronics imports from other parts of Asia are booming, however, although total volumes remain small. ICs from Korea were up 37% in November from the year before (to $31 million), those from Taiwan rose 16% (to $10 million), and those from newly developing Asian economies climbed 15% (to $48 million). Computer imports from the latter suppliers were up 46%, to $18 million.

The trade figures track *all* electronic imports to Japan, and thus include some production from Japanese-owned plants abroad. The data does not include the sales of large U.S. companies that manufacture in Japan.

—Paula Doe in Tokyo

TELECOMMUNICATIONS

Telecom could be the Bay State's high-tech savior

CAN MASSACHUSETTS' Route 128 Technology Highway make the transition from minicomputers to telecommunications?

Even before the recession walloped the Northeast, Route 128's minicomputer makers were being battered by the widespread acceptance of networked PCs. In 1991, the state's unemployment hit its highest level since World War II, and high-tech employment declined 5%.

Hope, however, is not lost, says a recent study by the Bank of Boston—it resides in Massachusetts' technologically advanced telecommunications industry. "Our analysis suggests that this industry should continue on a growth path during the rest of the decade," says the bank's chief economist Wayne M. Ayers.

His optimism is based on several facts:

- Massachusetts accounts for 11% of the nation's communications shipments and has the nation's highest concentration of these companies;
- The state's high employment declined in 1991, but communications equipment employment held steady, and companies with under 1,000 employees added 430 jobs last year—a 4.1% increase;
- Twenty-six telecom companies, or 19% of all the telecom companies headquartered in the Bay State, were started in the past three years, despite the recession;
- At the Massachusetts Institute of Technology, 15% of the licensing

agreements completed in 1991 were in the communications field, many in still emerging, innovative niches.

An excellent supplier network, complementary computer and software industries, and huge export potential makes Ayers's optimism seem well founded. While the Northeast will no doubt lag the rest of the nation in an economic rebound, telecom offers hope for the region's future.

—E. B. Baatz

MARKETS

Customer perception could hamper pen-based market

THE MARKET FOR pen-based computer systems is evolving at an unprecedented rapid pace, but the systems' near-term fate still isn't clear. Market projections are highly optimistic: BIS Strategic Decisions expects unit shipments to grow from 160,000 this year to 146 million by 1995. There are a few things that need to happen first, though, such as operating system availability and education of the potential user base.

Two of the three major pen-based operating systems for the broad business applications market are now unavailable to users. Microsoft's Windows for Pen Computing and Go Corp.'s long-awaited PenPoint operating systems are the two biggest expected catalysts for the pen market, but both have been delayed well beyond initial target shipping dates.

Users can get proprietary, niche-oriented operating systems from Grid Systems, Momenta, NCR, and Pi Systems, but at the risk of being tied to a limited number of applications. Other hardware vendors such as Samsung won't deliver volumes of their tablets until Go's and Microsoft's products become available.

Regardless of operating system availability, developers and users still perceive pen systems as virtually useless without handwriting character recognition capabilities. That is not necessarily true, and vendors have been taking pains to educate the market. They have a long way to go to convince most users they don't need handwriting recognition for now. The real point, vendors say, is using the pen as an input device as opposed to a keyboard or mouse, not whether the data is presented in script.

"This is not an evolution of the PC market," contends Go chairman Gerald Kaplan. "It is revolutionary, and we've got to educate the user/developer community as a standalone entity from the PC world. As long as people expect us to do what PC's can do and more, we'll never fully exploit the pen's true potential."

—David Webb in San Jose

COMPUTERS

Big companies to squeeze info systems budgets again

Who's spending on info technology

(Projected 1992 information systems budget by industry)

Industry	1992 spending plans: Growth from 1991	1992 spending plans: As % of revenue
Media & entertainment	7.5%	2.8%
Pharmaceuticals & medical products	7.3	2.5
Transportation services	7.3	2.1
Consumer products	6.4	1.5
Insurance	5.6	4.2
Banks & financial services	5.3	0.8*
Retail, restaurants, & wholesale	2.9	1.1
Telecommunications	2.4	8.6
Automotive	1.4	1.0
Computers & electronics	1.1	3.2
Utilities	1.1	1.7
Mining & metals	-0.3	1.4
Oil & energy	-2.2	1.0
Aerospace	-7.1	4.4

Based on an Oct. 1991 survey of 444 large (greater than $250 million) companies
* As % share of assets
Source: CSC Index

SALES OF computers, software, and systems to large companies have been harder to come by during the recession, and there's no end in sight to the squeeze in 1992. Information systems (IS) budgets have been cut again this year, according to a CSC Index Corp. survey of 444 senior IS executives in industries as diverse as banking, manufacturing, and media.

The 1991 survey predicts budgets will rise only 3.5% in 1992, after a 5.3% predicted gain in 1991 and a 6.9% increase in 1990.

Even the computer, software, and electronics industry forecasts only a 1.1% increase in IS spending in 1992, after a 10.5% projected budget jump the year before. Still, 71% of the 23 large North American companies studied say they will make significant information technology investments to upgrade order processing; another 63% will invest in manufacturing; and 58% in product delivery and logistics. Reengineering of key business processes, with attention to customers, appears to be the motivating force for whatever small budget increases electronics companies have planned in the coming year.

—E. B. Baatz

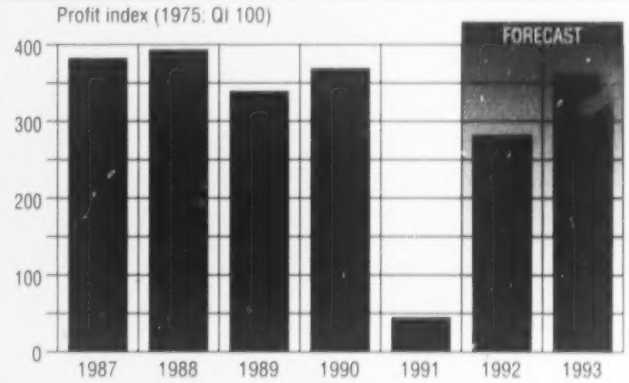
HUMAN RESOURCES

Tough stance on visas could mean more U.S. jobs

IT'S GOING TO GET easier for a U.S. engineer or manager to land a job with a Japanese-owned U.S. subsidiary, even if he or she is competing with a Japanese applicant.

The reason is that U.S. immigration officials are getting stingy on handing out visas. Nearly half of all foreigners in the U.S. on manager's

Profits crash in '91, to rebound in '92



Source: ELECTRONIC BUSINESS. Forecast: Cahners Economics

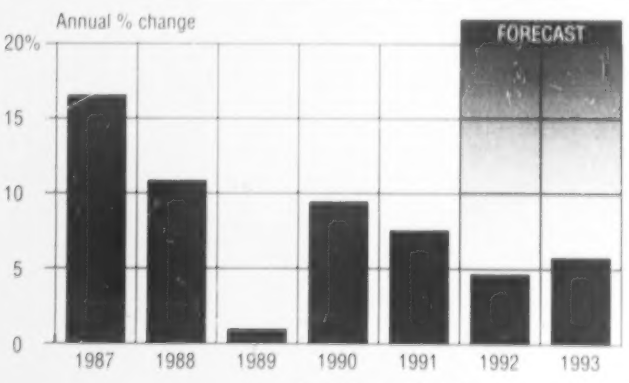
Gloomy outlook for electronics employees

Annual % change in employment by industry segment

			FORECAST	
	1990	1991	1992	1993
Semiconductors and components	-5.2%	-5.2%	-2.0%	0.1%
Consumer electronics	-4.4	-5.2	1.7	0.3
Communications	-3.4	-5.5	-1.1	-0.5
Computers and office equipment	-4.3	-4.6	-4.2	-3.4
Instruments	-2.2	-3.6	-2.0	0.5

Source: Labor Dept. Forecast: Cahners Economics

Medical electronics shipments growth slows



Source: Commerce Dept. Forecast: Cahners Economics

Lower interest rates will revive revenue growth

PROFITS

The forecast: Electronics revenue will grow 3% in 1992 and 5.3% in 1993. Restructuring will continue, but will be in the later, less expensive stage, which will help profits. **Recent history:** For the first time, the ELECTRONIC BUSINESS Revenue Index declined 0.3% in 1991. Add in costly restructuring charges, and the result was the worst profits performance of the past 16 years; the ELECTRONIC BUSINESS Profit Index plunged 88% in 1991.

EMPLOYMENT

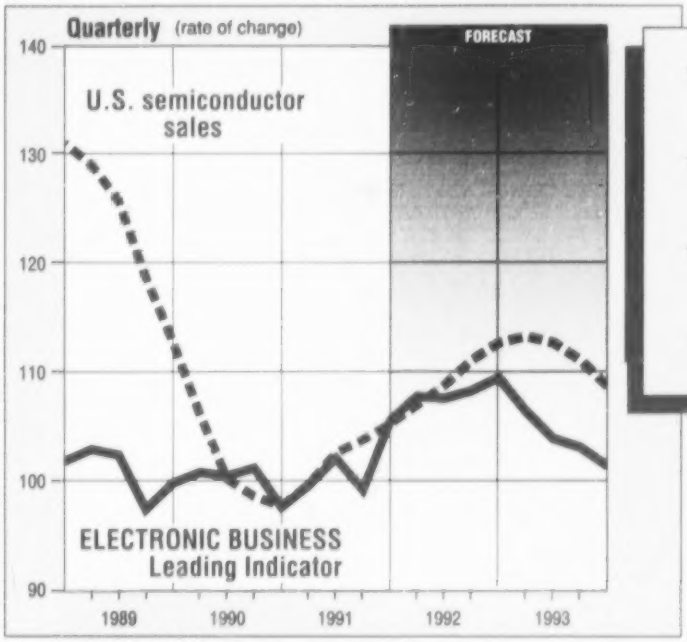
The forecast: Manufacturers will continue scaling back in 1992. Cahners Economics forecasts electronics employment will fall 2.2% again in 1992 to 2.1 million jobs. The software industry, not represented in the manufacturing job count, will continue to pick up the slack. **Recent history:** U.S. electronics factories squeezed out a 0.8% gain in output last year, but employment dropped 4.5%, much steeper than our original forecast of a 2% decline. The semiconductor/component (losing 34,000 jobs) and instrument industries (losing 31,000) experienced the most severe cuts.

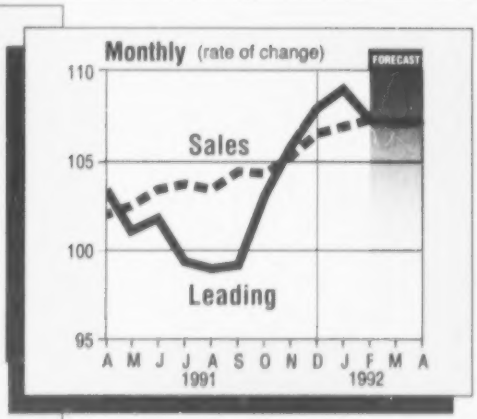
MEDICAL ELECTRONICS

The forecast: After climbing 7.5% in 1991, shipments of medical instruments will grow 4.6% in 1992 and 5.7% in 1993. Cuts in Medicare and employer-provided health insurance will dampen growth at home, but demand from abroad—where per capita medical care expenditures are still far below the U.S.—will grow strongly. **Recent history:** Growth in orders for medical instruments slowed to 4.7% in 1991 after averaging 9.3% over the past 10 years. Backlogs also declined 5.3%, falling for the first time since 1976.

J. Farrell and J. Handelman-Sagan

ELECTRONIC BUSINESS Leading Indicator



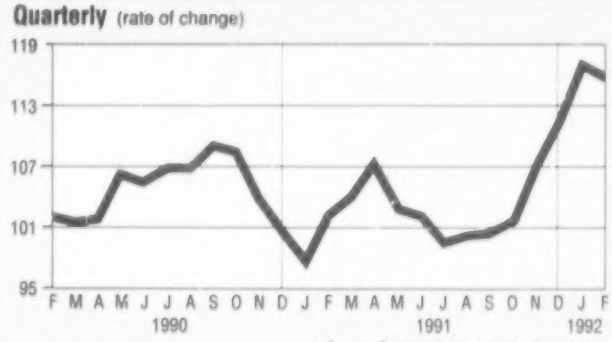


Leading Indicator up, up, and away?

THE ECONOMY may have staggered into 1992, but the leading electronics markets leaped into the new year. From its most recent low of 98.9 in August 1991, the ELECTRONIC BUSINESS Leading Indicator (EBLI) jumped to 108.9 in January and remained high, at 107.2 in February. Recent growth in semiconductor bookings is further evidence of the underlying strength of the EBLI's rise. The latest surge is expected to subside during the next five months, then turn upward again in August to reach a peak of 109.9 in December. Look for market growth in the electronics industry to peak in 1993.

—John Farrell

Chip orders provide foundation for optimism



Source: Semiconductor Industry Association

	Latest month	Previous month	Year ago	1991 average
ELECTRONIC BUSINESS Leading Indicator (rate of change, Feb.)	107.2	108.9	100.2	101.5
U.S. semiconductor bookings ($ millions, 3-month average, Feb.)	$1,518	$1,447	$1,350	$1,311
Weekly hours of semiconductor production workers (monthly average, Jan.)	42.2	42.4	39.9	41.1
Electronic components lead time index (1977 = 100, Feb.)	88.0	83.6	108.0	87.5
S&P's semiconductor stock price index (1970 =10, monthly average, Feb.)	91.5	83.7	70.3	68.5
Change in electronic components inventories ($ millions, SA, Jan.)	-$99	-$147	$5	-$53
Contracts and orders for plant and equipment ($ billions, SA, Jan.)	$34.4	$31.7	$37.7	$35.0

SA = seasonally adjusted; all other data are not seasonally adjusted

Sources: Semiconductor Industry Association, Bureau of Labor Statistics, *Electronics Purchasing* magazine, Standard & Poor's, Commerce Dept., Bureau of Economic Analysis, Cahners Economics

EBLI is a weighted composite of six statistics that lead activity in the electronics industry. To obtain a complimentary background paper, contact Michele Cooper, Cahners Economics, 275 Washington St., Newton, MA 02158-1630, USA; telephone (617) 630-2119; fax (617) 630-2100

Finding the right partner for the systems integration hustle

It's a $20 billion business growing 20% a year, but integrators' desire to be hardware independent make them fickle allies for OEMs

By Rick Whiting

Executives of computer manufacturers are eagerly searching for dance partners at the booming systems integration party. OEMs must learn some pretty intricate steps if they want to avoid tripping—they have to pick partners with an edge in strong vertical markets and accept the fact that their partner today could be their competitor tomorrow and a partner again next week. It's that kind of business.

Systems integration already accounts for $20 billion to $25 billion in annual sales, or about 15% of all user spending for information technology products and services, according to market researcher International Data Corp. in Framingham, Mass. While the computer industry as a whole is in the doldrums, IDC notes that systems integration sales are growing at about 20% a year and will reach $58.6 billion in 1996. G2 Research Inc. in Mountain View, Calif., is even more optimistic—it predicts that the systems integration market will reach $70 billion in 1995.

"Systems integration has become a key part of our business," Ken Olsen, president of Digital Equipment Corp. in Maynard, Mass., said at the company's annual meeting in November. Systems integration accounted for about $1.1 billion of Digital Equipment Corp.'s $13.9 billion sales in fiscal 1991 and is growing at 25% to 30% a year. "This is the fastest-growing part of the computer business," according to Olsen.

Everyone seems to have a slightly different definition of what it takes to make a systems integrator. "Some are just glorified value-added resellers," says J. P. Richard, principal consultant with market research firm Input Inc. in Vienna, Va. The general consensus is that systems integrators deliver a complete solution to customers by combining expertise in hardware, software, and communications technologies from multiple suppliers with knowledge about specific industries and business disciplines. "We try to understand in depth the details of [the customer's] business," explains Paul Cosgrave, managing partner for integration service and technology for the Americas at Arthur Andersen & Co.'s Andersen Consulting Division in Chicago, one of the largest systems integrators. "We have tremendous areas of focused, industry-specific expertise."

Systems integrators assume full financial and technical responsibility for projects, managing subcontractors, and serving as the single point of contact for the customer. Most contracts are awarded on a fixed-price basis, says George Newman, IDC's director of services research.

Several factors are behind the increased demand for systems integration services: the growing complexity of computers, the increasingly larger computer networks, and the move toward open standards that creates multivendor networks. "The systems integrator has

taken on a stronger role as computer vendors begin moving toward open systems and away from proprietary technology," says Mark Fowler, president and chief executive of Systech Corp., a $22 million company in San Diego that relies on systems integrators as a sales channel for its communications subsystems.

FURTHERMORE, major corporations that are overhauling their computer networks and trimming management information system staff create a greater demand for systems integration services, notes James Perkins, a consultant with market research firm G2. Adds Vernon Ellis, European managing partner of Andersen Consulting in London, "The fundamental challenge is to help companies restructure and re-engineer themselves."

Increased demand by corporate users for comprehensive technology service, the heightened complexity of technology, and the user preference for open systems represent lost opportunities for vendors that fail to recognize integrators as potential resellers or sales partners. "Every equipment vendor has to have some kind of systems integration channel," says Input's Richard.

Hewlett-Packard Co., for example, is currently selling more than $100 million worth of products through such systems integrators as Electronic Data Systems Corp. and Andersen Consulting, says Ronald Lim, systems integration channel marketing manager. Usually HP supplies only computers and related products to systems integrators but on occasion serves as a subcontractor when a project calls for special knowledge of HP products.

DEC plays both sides of the game, selling its products to other integrators and serving as a systems integrator itself. Through its own operation, Digital Equipment Corp. snagged PC networking contracts from the U.S. Navy and United Technologies Corp. late last year valued at $140 million and $80 million, respectively. In a subcontractor role, DEC is working with The Boeing Co. in Seattle on a $150 million contract to create a network of 28,000 computers at 4,700 U.S. Army Reserve and National Guard sites.

What is a systems integrator?

Knowledge of a variety of technical and business disciplines is required to succeed as a systems integrator

- Mainframe, minicomputer, and PCs from multiple vendors
- Applications software
- Telecommunications
- Computer networking
- Data communications expertise
- Backround in specific industries

Source: ELECTRONIC BUSINESS

Despite the increased demand for systems integration, the market is not hassle-free for computer makers, software developers, and manufacturers of other products. Eager to supply whatever product type or brand name their customers want, systems integrators are notoriously fickle when it comes to supplier loyalty. And the up-front investment required for a vendor to get on a systems integrator's "buy" list does not guarantee rewards.

The giants of the systems integration industry come from various backgrounds: those that have been systems integrators from the start, including EDS, Computer Sciences Corp. (CSC), Computer Task Group, and American Management Systems; aerospace companies such as Boeing that, having integrated their own sprawling computer networks, found there was a market to do the same for others; Andersen, Coopers & Lybrand, Price Waterhouse, and other accounting firms; and computer makers, particularly IBM and DEC, that figured out that simply dropping new computers off at customers' loading docks was leaving money on the table. IDC calculates that IBM is the leading systems integrator, with an 8% share of the market in 1990, followed by DEC with a 5.7% share and Andersen Consulting and EDS each with a 4.6% share of the market.

Many observers say the market is becoming glutted with aspiring systems integrators. Cap Gemini Sogeti in France, the leading systems integrator in Europe, is now making a major push into the U.S. market. Software companies such as Microsoft, Lotus Development, and Oracle have jumped into the systems integration game. As hardware and software profit margins fall, more companies are arming themselves with application software and screwdrivers and calling themselves systems integrators. "It's a buzzword," says IDC's Newman. The "massive restructuring going on within *Fortune* 1000 companies," however, will provide enough business for systems integrators to forestall an industry bloodbath, says G2's Perkins.

GENERALLY the major systems integrators cover all markets, although each segment has its leaders. IBM, for example, is the premier supplier of systems integration services to the banking, finance, and state and local government sectors in the U.S., according to G2. Arthur Andersen and EDS are the major players in the manufacturing arena. "We can bring expertise to a manufacturer as a systems integrator that's been on the factory floor," claims Kevin Curry, EDS director of corporate market analysis, referring to his company's experience with the manufacturing operations of its parent, General Motors Corp.

The federal government, especially the Department of Defense, has provided systems integrators with some of their biggest contracts in the past. However, commercial markets are larger and growing faster: Input estimates that in the U.S., commercial systems integration contracts in 1991 were valued at $4.4 billion, compared with $3.3

billion for the federal government. By 1996 commercial contracts will total $10.5 billion and federal government work $6.9 billion.

Smaller integrators make a living by concentrating on niches. Despite its generic name, System Integrators Inc. in Sacramento focuses exclusively on designing and installing computer networks at newspapers ranging from *The Washington Post* to the *Tiroler Tageszeitung* in Innsbruck, Austria. Aurora Systems Inc., an Acton, Mass.-based systems integrator, specializes in linking computer and telecommunications networks for telephone-call processing; and ERI of Hauppauge, N.Y., offers full systems integration services at the departmental level, picking up the $500,000 or $1 million contracts that EDS and other giants consider small change.

Faced with the fragmented state of the systems integration market, OEMs have pursued a variety of strategies to pump their wares through this lucrative channel. Some simply use integrators as resellers while others team up with systems integrators—with either party serving as the prime contractor or subcontractor. Others are themselves systems integrators. Many juggle all those roles.

Compaq, NCR, and Pyramid Technology, all in the early stages of forming partnerships with systems integrators, represent three popular approaches to entering the business. Compaq launched its program last October and recently tapped EDS as its first partner, as it concentrates on the bigger players. NCR is looking for a select group of small but dominant niche integrators, while Pyramid offers its own integration services and partners with a few niche companies.

NCR's Systems Integrator Alliances group gives systems integrators a single point of contact within the Dayton, Ohio, company's U.S. marketing organization. In November NCR inked a $2 million deal to supply its System 3000 and pen-based computers to Information Decisions Inc., an Indianapolis-based systems integrator specializing in manufacturing, financial, and state and local government projects.

NCR plans to ally itself with, at most, 10 to 12 such integrators, says Mike Ruffolo, director of NCR's systems integrator alliances channel. "We don't feel we need that many relationships to do a good job," he says. "You can cover a lot of territory if you have good alliances." NCR is using three criteria in its search for partners: Ability to provide custom solutions for buyers, experience at project management, and willingness to take on the role of prime contractor.

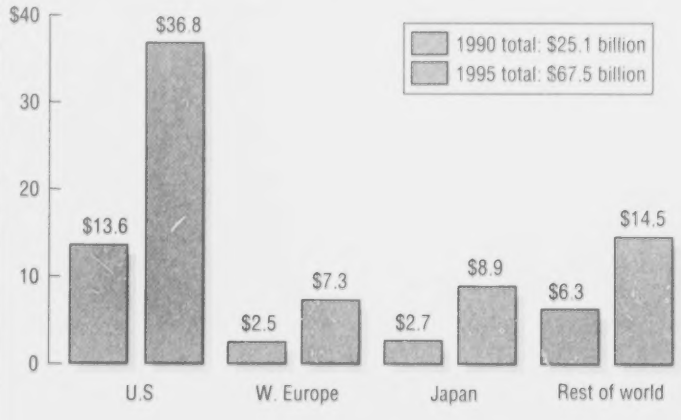
BY TEAMING WITH systems integrators with niche expertise, Pyramid is able to go after sales it had to pass up before, even though the Mountain View, Calif., computer vendor runs its own systems integration operation. Pyramid recently established an alliance with CGS Computer Associates Inc. in Iselin, N.J., which targets systems integration jobs involving financial applications and imaging technology. "This is the first of a limited number of teaming relationships we're going to form to address certain vertical markets," says Bob Wardell, director of Pyramid's Professional Services unit.

Pyramid is not alone in focusing on systems integrators in specific vertical markets. "If you target the right niche, there's plenty of activity," says Chris Fairclough, president of Dublin, Ireland-based Mentec Computer Systems Ltd., which markets board-level computers to integrators in telecommunications, manufacturing, and utility markets. Revenue from systems integration projects within the manufacturing sector alone will reach $7.7 billion by 1996, predicts G2, and $4 billion from utility companies. Systems integration spending by health care, telecommunications, and insurance companies are each expected to exceed $2.5 billion by then.

Not surprisingly, systems integrators choose their suppliers either on the basis of price or technology, says W. Neil Armentrout, marketing senior vice president of QMS Inc. in Mobile, Ala., which sells between $4 million and $5 million in laser printers through integrators. Some systems integrators, including EDS and

Systems integration services in demand worldwide

Systems integration regional markets
($ billions)



Source: G2 Research

Andersen Consulting, look for the lowest cost products that meet customer specifications, according to Armentrout. Others, including CSC in El Segundo, Calif., select their suppliers on the basis of product sophistication to sell more advanced technology to customers.

Hardware suppliers can make themselves more attractive to systems integrators by providing such incentives as support hotlines and design teams dedicated to work with integrators, says Input's Richard. "They must find creative ways to differentiate themselves," he says.

NCR, for example, maintains dedicated systems integration resources in both its headquarters and in field offices. The computer maker's own sales force develops joint-marketing initiatives with integrators that target vertical markets. Some computer makers, IBM among them, offer systems integrators what Aurora Systems CEO Paul M. Gasparro calls "influence fees" of up to 10% of a contract's value if the integrator's software helps to close a sale. "One of the best ways to start a relationship with a systems integrator is to use your own direct sales force to generate a lead and then approach a systems integrator with a proposal," says G2's Perkins.

Getting onto a systems integrator's list of subcontractors by no means guarantees a continuous flow of orders. To offer their customers as many choices as possible, systems integrators prefer to be hardware independent rather than standardize on a few platforms. EDS, for example, has contracts with more than 6,500 suppliers. "We are truly the best open hardware vendor because we don't make hardware," says Arthur Andersen's Cosgrave. "Consultants are hired for a lot of reasons, but one is objectivity. That's hard to be if you've got a vested stake in the technology."

Gaining the attention and loyalty of a systems integrator takes work. "It takes time and energy to understand how these companies work," says Neil McGowan, director of integration and engineering services at Tandem Computers Inc. in Cupertino, Calif. However, OEMs should not allow themselves to be sucked too deeply into supporting integrators. IDC's Newman says suppliers must take care to avoid "overcommitting resources in relation to the potential return from the channel."

Given the continuing plunge in profit margins on computer hardware along with systems integrators' unwillingness to lock themselves into any one vendor's platform, fewer systems integrators today appear to be buying computers and reselling them as part of a total solution. Instead, they are calling in computer makers to serve as subcontractors, which suggests that manufacturers of computers and other equipment should view systems integrators less as product resellers and more as marketing partners.

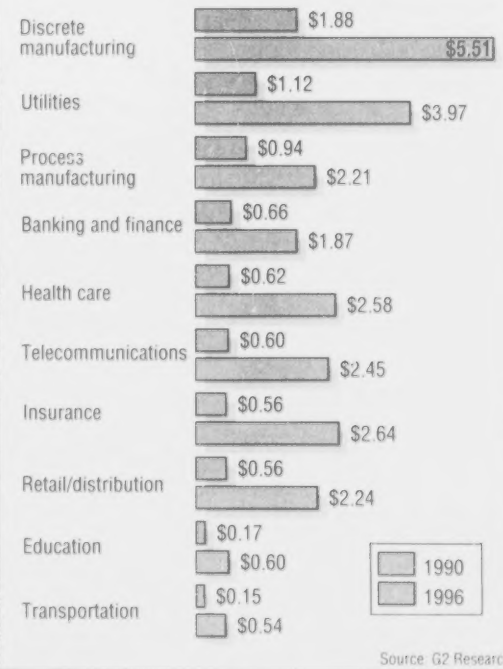
Indeed, the shifts in the systems integration business reflects the mercenary nature of the market: Today's collaborator could be tomorrow's competitor. Dallas-based EDS, for example, is the largest buyer of IBM products outside of the federal government, even though EDS and IBM compete head-to-head for systems integration contracts. "That's the nature of the business," says Newman. "It's done on a deal-by-deal basis."

Another fact of life in the market is the not surprising tendency of OEMS to push their own gear when wearing their systems integration hats. The majority of gear they sell will be their own, though they down pedal that aspect of their service in pitches to customers. IBM tries to reassure potential customers about its objectivity. "It may surprise you, but around 40% of a typical IBM project goes to non-IBM sources," the company noted in a recent advertising campaign. A DEC spokesman notes that it resells gear from Tandy, Apple, Intel, Olivetti—even IBM—and provides service and support for some 10,000 products from 1,000 vendors. "If [customers] want a competing product that will work equally well, then that's what they will get," says the DEC spokesman. □

Additional reporting by Barbara N. Berkman in London

Hot vertical markets for systems integration

Spending by *Fortune* 1000 companies by vertical markets ($ billions)



Source: G2 Research

A clash of giants shakes the low-end workstation market

Sun, DEC, IBM, and HP are in a bruising battle for market share as they push low-end workstations into commercial areas dominated by PCs

By Rick Whiting

According to the rules of leapfrog, it should be Sun Microsystems Inc.'s turn to make the next price/performance jump. IBM, Hewlett-Packard, and Digital Equipment Corp. have in recent months unleashed new workstations with price tags in the $4,000 to $6,000 range. Mountain View, Calif.-based Sun, once considered the leader at the low end of the workstation market, now finds its prices in the middle of the pack and is expected to fight back shortly with new lower-priced products. "The whole market has essentially changed in the last few months," says Tom Kucharvy, president of Summit Strategies Inc., a market research and consulting firm in Boston.

Despite the recession, the workstation market grew some 15% last year, to $8.8 billion, according to market researcher Dataquest Inc. in San Jose. It predicts that workstation sales will increase around 25% to $10.9 billion this year, although those estimates will likely be revised downward if the recession drags on. Reflecting the increasing number of low-end workstations sold for less than $6,000, however, the market research firm expects total unit shipments to climb 53% to 790,500. That volume surge will squeeze the average price for a workstation from $16,750 last year to around $13,800. However, workstations with price tags between $15,000 and $20,000 remain the single largest segment of vendors' hardware revenue, Dataquest says.

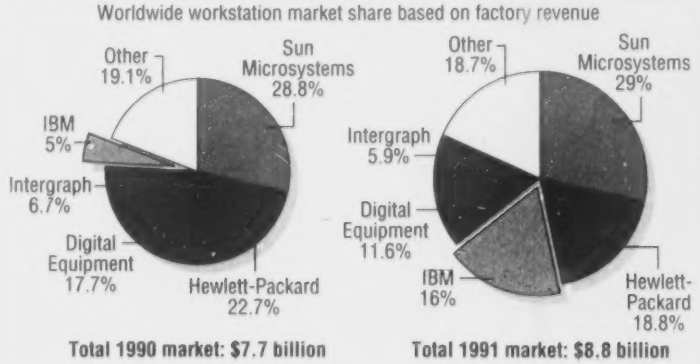
And despite falling prices, analysts and customers say workstations still have a long way to go before they become as commodity-like as personal computers. Unlike PCs, which are based on a single operating system (DOS) and microprocessor family (the 80x86 from Intel Corp. in Santa Clara, Calif.), workstation vendors can still differentiate their computers by using different microprocessors, software, graphics capabilities, and other features. Although profit margins are tightening at the low end, no one foresees the kind of margin collapse among workstation manufacturers that hit PC vendors last year.

The entry-level market is critical for workstation vendors, however. Low-priced units provide DEC, Sun, and other companies with a foot in the door to new accounts. Even more important, the under-$10,000 machines are the vehicles that most workstation suppliers ride to penetrate the potentially huge commercial market. While scientists and engineers require the power and graphics capabilities of a $20,000 workstation, commercial users are buying sub-$10,000 workstations as alternatives to PCs. "That's the hot area," says Laura Segervall, senior industry analyst at Dataquest.

For several years, vendors have been selling workstations to securities traders, publishers, and other commercial customers who require extra number-crunching power, multitasking functionality, sophisticated graphics, and advanced networking capabilities, but manufacturers see those initial marketing forays as just testing the waters. "This is the year

IBM's gain is DEC's and HP's loss

Worldwide workstation market share based on factory revenue



Source: Dataquest Inc.

that workstations begin to make the leap into the general commercial market," predicts Gary Eichhorn, general manager of HP's Workstation Business Unit in Palo Alto, Calif.

International Data Corp. in Framingham, Mass., forecasts sales of commercial workstations at 720,000 units, or 35% of the total market by 1995. Sun has had the most success among workstation vendors selling to commercial accounts—it lists customers such as Northwest Airlines, Dunkin' Donuts, Healthcare Affiliated Services, and Yale University. The company estimates that about 30% of its sales are to commercial customers, with the balance sold for scientific and technical use. IDC expects that by 1994 one-half of Sun's workstations will be sold for commercial applications.

Dunkin' Donuts Inc. in Randolph, Mass., may be typical of the corporate interest and use of workstations. Its handful of Sun Sparcstations have brought productivity benefits to in-house systems developers and database administrators. The question MIS director Dave Bennet is trying to resolve is at what price point workstations make economic sense for the more routine office chores done by its 400 personal computers. "The price points do seem to be sliding in the right direction," he says.

Dave Bradley

Workstation "price points seem to be sliding in the right direction," says Dave Bennett, Dunkin' Donuts' MIS director

DEC WAS THE FIRST workstation vendor to fire a volley in the latest battle over the low end when it began marketing additions to its DECstation 5000 line of workstations in December. The Maynard, Mass., company's lineup includes the Model 20 and Model 25, with entry prices of $3,995 and $4,995, respectively, giving the company bragging rights to having the lowest priced RISC workstation on the market. The DECstations are based on the R3000 RISC chips from Mips Computer Systems Inc. in Mountain View, Calif., and, like other vendors that rely on the Mips microprocessors, DEC has been hurt by Mips's delay in getting out its next-generation R4000 chip. The DECstation is relatively low-powered compared with entry-level workstations from its competitors (see table, page TK). DEC also markets the VAXstation line of workstations based on its proprietary VAX technology.

The DECstations' selling point is that they are more upgradeable than competing systems and will not become obsolete within six months, contends Domenic LaCava, vice president of DEC's Unix-based Software and Systems group. The DECstations offer the option of installing the R4000 chip when it becomes available, for example, and the Model 20 includes two TurboChannel slots for adding peripheral devices and other hardware. "Customers are buying the systems because they see a future for them," LaCava claims.

The future isn't clear, though. DEC is expected to begin marketing by the end of the year workstations based on its own RISC microprocessor known as "Alpha." Because DEC also promises to continue marketing workstations using the Mips chip, the company faces the challenge of supporting two different workstation platforms (three, if it continues the VAXstation line) and risks creating confusion among buyers, says Nancy Battey, director of workstation research at IDC.

Early this year, IBM retaliated in a bid to accelerate the market momentum gathered two years ago with the debut of its RS/6000 workstations. It unveiled, among other additions to the RS/6000 line, the PowerStation 220 with a bottom-line price tag of $6,345. That system could account for 20% to 25% of the company's workstation sales this year, according to IBM. The system is based on a single-chip implementation of IBM's RISC processor technology, while earlier models required a CPU with from seven to nine chips. The PowerStation 220 is still priced higher than entry-level offerings from HP, DEC, and Sun, but analysts say IBM has focused on providing a well-rounded system rather than the lowest price or the most impressive price/performance ratio.

IBM's workstation strategy has served it well. From the negligible market share the company held in the late 1980s with its failed RT, IBM snagged 16% of the market in 1991 with the RS/6000, according to Dataquest, surpassing DEC and capturing third place behind HP and Sun. "We're still not the market leader, but we're coming up fast," boasts Bill Filip, president of IBM's Advanced Workstation Division.

RS/6000 sales reached $1 billion in the line's first year, company officials claim, including software and other add-on products. IBM executives have been more closed-mouthed about specific sales figures since then, but they say the company achieved its goal of a 50% to 70% sales increase in 1991 and is shooting for another 50% increase this year. That would put RS/6000 sales well over the $2 billion mark. Despite the gains, however, IBM's efforts were handicapped by the lack of a low-end workstation—its cheapest RS/6000 was priced at nearly $14,000—until its recent announcement.

HP also introduced new low-end products in January to regain its position as a price/performance leader. The Model 705 has a starting price

HP holds the performance lead at the low end

(Specifications for major vendors' entry-level RISC workstations, based on minimum system configuration with a monochrome monitor and without a disk drive)

Company	Workstation	Price	RISC chip	Power rating (SPECmarks)	Assessment
HP	HP/Apollo 9000..... Model 705	$4,990	PA-RISC	34.0	Best price and performance, limited upgradeability
IBM	RS/6000 ..... PowerStation 220	$6,345	RS/6000	25.9	Entry-level IBM workstation, higher priced than competitors
Sun	SparcStation ..... ELC	$4,995	Sparc	20.3	Relatively low-powered, limited upgradeability
DEC	DECstation 5000..... Model 20	$3,995	R3000	16.3	Lowest price, upgradeable,
	..... Model 25	$4,995	R3000	19.1	but low-powered

Source: Company reports

of $4,990, and the Model 710 carries a $9,490 price tag for a basic diskless system. The new computers, at least for the moment, allow HP to maintain its claim of having the most powerful workstations for the money. "Right now, I would say that HP is the strong player," says Dataquest's Segervall.

IRONICALLY, LIKE IBM, HP had been just another vendor written off as an also-ran in the workstation race. After HP acquired Apollo Computer in 1989 and found itself in a virtual tie for market share with DEC and Sun, the company slipped as it struggled to integrate the two companies. (That slip once prompted Sun CEO and president Scott McNealy to quip that Apollo, which marketed the first workstations in the early 1980s but later fell behind Sun, lost the workstation market lead *twice*.)

HP turned around that also-ran image last year when it introduced its 700 Series workstations based on its Precision Architecture-RISC microprocessors. HP was unable to keep up with demand for the new systems, due in part to a shortage of floating-point processor chips from Texas Instruments Inc. in Dallas, which constrained shipments of the line's more powerful systems until early this year. Nevertheless, UBS Securities Inc. analyst Marc Schulman in New York estimates that sales of the 700 Series are running at more than $1 billion a year and now outpace HP's aging Series 400 workstations based on Motorola's 680x0 chips. "The majority of our new customers are going for the 700 Series," Eichhorn acknowledges. Adds Harold Hickman, director of computer operations for Northrop's Information Services Center in Los Angeles, which recently purchased $5 million worth of Series 700 workstations and related equipment for its manufacturing operation, "we chose HP because it offered the price-performance superiority we needed."

Some observers do note that, while the Series 700 leads in terms of raw power, the workstations are more limited in configurability that competing systems. The Model 705, for example, has no expansion slots, and customers still have to ante up more than $11,000 for a color system.

HP's drive for the entry-level market is prompting its search for a suitable distribution channel for its low-end workstations, an obstacle all workstation suppliers face in trying to crack the commercial market. By their nature, workstations require more service and support than personal computers and so cannot be easily sold through mass merchandise channels. Last October, HP inaugurated a program to sell workstations and other gear through qualified dealers and signed MicroAge Computer Centers in Tempe, Ariz., and Intelligent Electronics in Exton, Pa., as the program's initial participants.

So what is happening at Sun? "One year ago, Sun Microsystems was the only vendor with a competitive system below $10,000," says Robert Herwick, managing director of technology research at Hambrecht & Quist investment banking firm, but it has fallen behind. The SparcStation ELC, currently the low end of Sun's line, has been on the market since July 1991 with a starting price of $4,995. At 20.3 SPECmarks, it is faster than DEC's Model 20 but falls short of competing HP and IBM workstations.

Sun's McNealy concedes that, in terms of providing monochrome workstations under $5,000, his company is no longer the leader, but he argues that Sun leads the market forcomputers under $10,000 with color and other capabilities. "We still feel pretty confident about the under-$10,000 market," he says.

Sun is known to be working on two new implementations of its Sparc RISC microprocessor—the high-end and low-end versions are code-named "Viking" and "Tsunami," respectively—to power its next wave of workstations. McNealy only hints at a "busy product calendar" for 1992 and declines to say more.

The dark horse in the commercial workstation market is Steve Job's Next Computer Inc., Redwood City, Calif., which is specifically marketing its 68040-based Turbo "professional workstations" for commercial use. Turbo prices start at $6,995 and the company recorded sales of $127.5 million in 1991. Customers include securities trading firms Lehman Brothers and UBS Securities, and the Los Angeles County Sheriff's Department. □

Multimedia mania: Time for a reality check?

The marriage of PC, VCR, and TV will spawn a multibillion-dollar consumer-electronics market in a few years. Maybe

By Connie Winkler

After five-plus years of hype, and sometimes faked demonstrations on the alleged wonders of multimedia, many knowledgeable users and even those in the industry remain confused. Until several major vendors finally unveiled their multimedia products late last year, the most frequently asked question about multimedia was, "What is it, anyway?"

The spate of announcements last October and earlier this year, though, and the arrival of at least some systems on the store shelves, have cleared the air a bit. Now it's possible to understand what the manufacturers are talking about in terms of consumer versions of multimedia products.

At its simplest level, multimedia is the combination of several electronics technologies under one hood. One of the most popular configurations includes a high-performance PC with a CD-ROM player, a sound board, and hi-fi speakers. Another variation adds high-quality, sophisticated video playback. Applications developers combine these elements into games, education, and entertainment software. Multimedia disks for children have become the electronic equivalent of old-fashioned pop-up books: "Gramma and Me" from Broderbund Software Inc. in Novato, Calif., includes birds that fly and screech and a talking grandmother, and the child uses the mouse to double click on the bird or other story elements. Users can search through text, graphics, video, and sound clips as if their PC was linked to a video cassette recorder and a color television set.

Apple Macintosh zealots, and the rare Next computer user, pooh-pooh

A Macintosh computer running the VideoShop software from Digital Video Applications Corp. in Cambridge, Mass., created a multimedia presentation for visitors to Ben & Jerry's ice-cream factory. Company videos, video clips from The Image Bank, and sound effects were edited into an interactive system for a lobby kiosk. The icons in the upper right section of the screen represent special effects, image clips, and other elements. VideoShop enables users to edit videos and the sound track on a frame-by-frame basis, as seen at the bottom of the screen

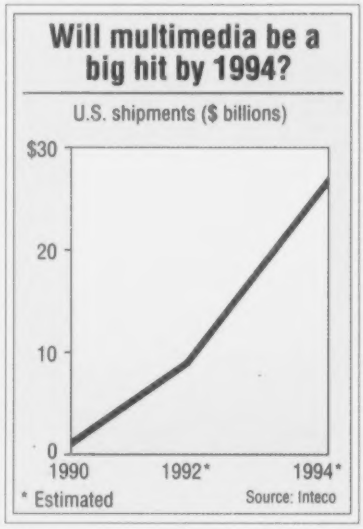
Screen images © 1992 Ben & Jerry's Homemade Inc.

the sudden hoopla over text, graphics, and sound coming from desktop computers, saying these capabilities have been available to them for years. For the rest of the world, however, the point is that multimedia systems handle text, audio, and video in a package that costs less than $3,500.

MANY INDUSTRY executives view entertainment as the right direction for their company, especially if they make personal computers, although they initially targeted narrow markets such as industrial training. "Multimedia will unleash extraordinary potential for consumers," notes IBM president Jack Kuehler. "It will become a revolution in the computer-to-person interface." Executives such as John Sculley, the chairman of Apple Computer Inc. in Cupertino, Calif., go even further. He predicts that the multimedia revolution is an opportunity for U.S. companies to regain domination of the consumer electronics industry from Japanese vendors.

Maybe. But it probably won't happen right away. The dearth of software titles and the price are major obstacles to a lush consumer market. As Sony, Matsushita, JVC, and other Japanese companies have learned, consumer electronics sales are driven by software, and the demand for multimedia depends on what can appear on the screen. "Applications are too narrow—they don't appeal to a broad enough group of people, and most consumers aren't prepared for higher levels of interactivity," notes market researcher Michael Mascioni, who follows interactive multimedia for the market research firm Alexander & Associates in New York City. He suggests that couch potatoes don't know what to do with the capabilities of multimedia systems. Indeed, he's only half joking when he says that interactive multimedia may not take off until the Nintendo-MTV generation gets more purchasing power—and prices drop significantly.

Currently, there are only about 100 true multimedia titles available in various formats among 5,000 database CD-ROMs. Not including internally developed commercial applications, sales of CD-ROM based multimedia software will hit about $300 million this year, predicts Larry Shiller, president of the Bureau of Electronic Publishing Inc., a Parsippany, N.J., distributor of CD-ROMs. Industry officials predict that the number of titles will double by year's end. "About 25% of all CD-ROM disks sold last year were multimedia, but 75% of CD-ROM sales will be multimedia this year due to the surge of new titles," notes Shiller.



One of the hottest offerings in 1992 will be the multimedia version of *Time* magazine, from Compact Publishing Inc., in Washington, D.C., according to Shiller. The disk includes video from CNN, Time articles and pictures from 1923 to 1991, the Central Intelligence Agency's World Factbook, and other U.S. government data manuals. Robert Ellis, Compact's publisher, predicts retail sales of 5,000 to 10,000 units at $149 each through electronics stores like Circuit City.

The more conservative industry officials and market forecasters acknowledge that multimedia won't be a major consumer product and market until mid-decade. "I really believe that in a couple of years, trying to buy a PC without multimedia will be like trying to buy a car in Texas without air-conditioning," exclaims Ed Juge, the head of marketing for Fort Worth, Tex.-based Tandy Corp.

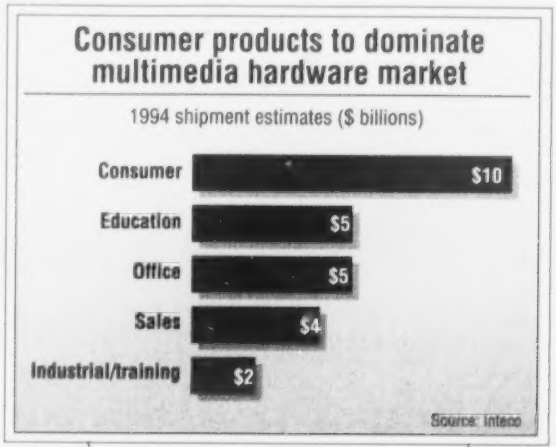
A $10 billion consumer hardware market by 1994 is forecast by Inteco Corp., a Norwalk, Conn., market research firm, along with a $5.5 billion software market that includes nonentertainment PC software such as spreadsheets and word processors with multimedia features. Alexander & Associates guesses that interactive entertainment hardware and software may be a $10-billion-per-year industry by the mid-1990s, or bigger than the projected market for HDTV. The multimedia boom is based on a low-cost—$500 or so—CD-ROM drive add-on to PCs capable of handling full-motion video and hi-fidelity audio and the availability of thousands of applications.

Forecasts of a three- to five-year evolution of multimedia into a consumer product are based on the pattern established for other advanced home electronics such as the VCR and the microwave oven. Interactive entertainment "as a consumer market is not springing up fully organized and rationalized," noted a recent Alexander & Associates report on Interactive CDs. "It will go through the same kinds of struggles that the VCR market and personal computer markets have had to suffer."

Mascioni notes that the comparison between multimedia and VCRs has a flaw—the movies that spurred demand for VCRs were an old wine waiting to be repackaged in a new bottle. Interactive media is barely at the grape-stomping stage—compelling software isn't sitting around waiting for someone to repackage it for a box full of microchips.

WHILE WAITING for the consumer titles and lower-priced hardware, vendors are focusing on a thriving market for commercial applications, each representing a relatively narrow niche. Advertising agencies mock up television cam-

paigns on Macintosh computers outfitted with multimedia hardware and software. Stand-alone PCs equipped with a CD-ROM player, speakers, and a color screen are used as information kiosks for customers at auto dealerships, clothing stores, and other retail venues. Among the hottest business applications touted by IBM, Intel, and other vendors is a video version of electronic mail—office workers would create video messages at the desktop and distribute them via local area network.



Commercial applications and the education market are driving a $6 billion hardware market for multimedia this year, according to Inteco. The 1992 consumer hardware market will ring up almost $3 billion in sales if the economy shows signs of improvement by mid-year and the surge of promised titles actually reaches stores.

Schools and libraries represent the largest commercial sector, at $2 billion this year. Electronic versions of encyclopedias are the top sales category of multimedia disks, according to Shiller. Encyclopedias and history texts are gobbled up by libraries as a way of attracting the Nintendo generation to reading.

Sorely missing from most PC multimedia specs is the capability to handily and cheaply present a high-quality and full-screen video on a PC. One minute of multimedia programming with a true-color, full-motion video occupies more space than is available on a 660-megabyte CD-ROM disk, so the consumer market depends on data compression. Although every day there's another option, no solution available today provides the necessary compression/decompression at the $500 price target for a consumer market to develop; the Digital Video Interactive (DVI) boards from Intel Corp. in Santa Clara, Calif., costs around $2,000. More than a dozen established semiconductor vendors, start-up software companies, and fabless chip makers are working on video compression, though, and prices are predicted to erode rapidly this year (see "Chip makers race to solve video puzzle," page 100).

ANOTHER PREREQUISITE for a multimedia system, and a key enabling technology, is a CD-ROM player. The lack of compelling software has limited consumer penetration for the drives, although sales are growing rapidly to business users. Shipments should triple by 1995, to 1.25 million units, from the 400,000 units achieved in 1990, according to Freeman Associates, a data storage marketing consultant. However, "1.25 million CD-ROM drive units will be only 10% of the, say, 10 million PCs shipped," notes Bob Abraham, vice president of the Santa Barbara, Calif., research firm, "but 10% penetration will be more than a moral victory." Currently, low-end CD-ROM players are available from mail-order houses and discount retailers for less than $500.

Not surprisingly, another major obstacle to a broad-based multimedia market is not a lack of technology, but a surfeit of it. Anyone who has tried to get data from one graphics, text, or video application into another—even with software supposedly designed for the same platform—probably would prefer a tooth extraction without anesthetic to doing it again. And forget about moving graphics across platforms. "Multimedia is not significantly different from any other emerging area of technology that has tremendous potential," says Larry Lytle, until recently executive director of the Interactive Multimedia Association (IMA) in Washington, D.C. "There are going to be standards issues." IMA has taken the lead to resolve the incompatibilities by drawing together more than 240 companies into a Compatibility Project to hew standards. "Instead of half a dozen technologies or standards, we may have two or three, as with Unix," Lytle predicts.

Typical of any nascent computer market, other standards are evolving. In the late 1980s, Microsoft Corp. in Redmond, Wash., recognized the need for standards and began a campaign to rally other supporters. By 1991, AT&T, NEC, Philips, Tandy, Zenith, and more than a dozen other manufacturers and developers eager for technical standards jumped onto Microsoft's bandwagon touting its Windows environment for DOS with multimedia extensions and data interchange standards as a common interface; notably absent from the group were IBM and Apple. Shelling out $250,000 each (primarily for big bucks advertising and public relations) these manufacturers set up the Multimedia Personal Computer (MPC) Marketing Council attached to the Software Publishers Association of Washington, D.C. Although originally the standard settled for as little as an Intel 80286-based system, by December 1991, Microsoft had acknowledged the need for more power, and the standard is now a 80386SX-based system.

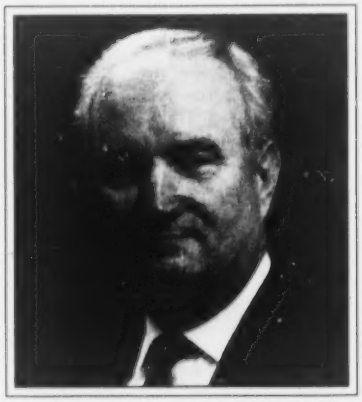
Of course, not everyone agrees with the MPC Council's approach. "I

can't imagine doing multimedia if you exclude IBM and Apple," snipes Lytle, the former IMA officer. Furthermore, the 80286 spec delayed multimedia development by at least six months while developers wrestled with it, contends Graham Taylor, executive vice president of Inteco. "Microsoft had egg on its face. However, the other standards are a big help to the Windows community. MPC will be a major force to be reckoned with."

HERE'S A LINE-UP OF the multimedia game's players and their strategies:

• **Philips** "The era in which individuals and families can interact with their television sets for entertainment or to learn about virtually any subject arrived today," boasted Jan Timmer, president and chairman of Philips Electronics, N.V. in the Netherlands, at the splashy New York announcement last October for CD-Interactive, its VCR-like box cum microprocessor which plays CD-ROMs and attaches to a TV. Industry observers estimate that Philips has spent hundreds of millions of dollars introducing CD-I.

The early reaction to Philips's marketing blitz is indicative of the marketing challenge facing vendors. Although CD-I was introduced at $1,000 at some major audio and computer dealers, by Christmas 1991 the suggested retail price was cut to $799 in the face of modest demand, and it was available in New York City for $750. To boost its utility, Philips is working on full-motion video on CD-I.



"Buying a PC without multimedia will be like trying to buy a car in Texas without air-conditioning," predicts Ed Juge, Tandy's director of market planning

• **Commodore** In February 1991, Commodore took the initiative in introducing CDTV, an interactive CD-ROM player, similar to CD-I. However, by late 1991, Commodore officials said that the company had shipped only 30,000 units worldwide at a retail price of $799, also discounted. Industry observers note that CDTV has been more successful in Europe than in the U.S. and warn that the company doesn't have the financial resources necessary to market the product.

• **Apple** Last year Apple introduced QuickTime, a group of extensions to its Macintosh operating system that allows developers to integrate sound, video, and animation within applications. In addition, the company also unveiled video compression and a CD-ROM for multimedia applications development.

Dozens of software and hardware vendors have announced support of QuickTime, including Aldus, RasterOps, WordPerfect, ABC NewsInteractive, and Radius. A consumer-oriented Macintosh bundle will ship to retail stores later this year, Sculley announced at the Consumer Electronics Show last month. QuickTime will be contributed to Kaleida, the joint IBM-Apple effort to develop multimedia standards and software.

• **IBM** IBM's Atlanta Multimedia Systems Group in October announced a multimedia PC and a big thrust into the market for sales tools. The PS/2 Ultimedia Model for $5,995 has advanced Extended Graphics Array technology. Users can add full motion video through IBM's adaption of Intel's DVI technology, called IBM PS/2 ActionMedia II adapter board, for $1,995. Or they can watch television feeds on the PS/2 screen via the $495 PS/2 TV screen.

IBM also introduced two mega-multi-media learn-

The outlook for the players and their strategies

Quotes from market analysts

Vendor	Markets	Outlook
Apple	Consumer Education Developers	"Easiest to use... successful in rallying allies"
Commodore	Consumer Developers	"Will it have enough money?"
IBM	Training Sales	"A leader... targeting Apple's strengths"
Kaleida (IBM & Apple)	Consumer Software	"Will take a big slice of these business"
Microsoft	Consumer Developers' software	"Major force to be reckoned with"
Philips	Consumer	"Good try... but will it keep spending?"
Tandy	Consumer Small business education	"Ideally placed... strongly positioned"
Japanese companies	Consumer	"Cautious"

Source: ELECTRONIC BUSINESS

Chip makers race to solve video puzzle

REAL-TIME full-motion video is the Achilles heel of multimedia. Television quality video requires displaying 30 frames per second on the screen, and each frame requires 1 megabyte of data. Video compression and decompression technology must squeeze hundreds of gigabytes of data required for an hour-long video to be stored on a 660-Mbyte CD-ROM. The challenge, and the potential for consumer sales, has attracted so many chip makers including the major semiconductor makers, established vendors, and start-ups that a bloodbath is predicted. "Competition and the erosion of pricing among video compression chip vendors will closely resemble the disk drive business in the 1980s," warns Nick Arnett, chief analyst of Multimedia Computing and Presentation Corp.in Santa Clara, Calif.

RCA's David Sarnoff Laboratories in Princeton, N.J., pioneered video compression in the late 1980s. Intel Corp. in Santa Clara bought RCA's Digital Video Interface (DVI) technology in 1988 from its parent, General Electric. In February 1990, Intel introduced a two-board DVI system for PCs (priced at about $4,500) that compressed video at a 160:1 ratio. The current version of the key video chip is essentially a CMOS processor with around 300,000 transistors, running at a 25-megahertz clock rate and capable of around 25 MIPS. "DVI is the only technology that does full-motion, full-screen video," notes Arnett. The latest two-chip set sells for $85 in OEM quantities, but an Intel official predicts a $50 price tag later this year.

Among Intel's video compression competitors is Integrated Information Technology Inc. of Santa Clara. IIT's video processor chip boasts compression ratios of up to 1,000:1. Boards based on its 33-MHz chip, which is made by National Semiconductor Corp. in Santa Clara, are available for Macintosh computers as well as for PCs. IIT's chips are the heart of AT&T's recently announced Videophone 2500. Prices for a two-chip set begin at $85 in OEM quantities. Additional competitors include Motorola, AT&T Microelectronics, and the major Japanese semiconductor makers, and each has announced a video compression chip project.

Other video compression players include a start-up, Fluent Machines Inc. in Framingham, Mass., funded in part by Cirrus Logic Inc. in Fremont, Calif. Its CMOS chips will be fabricated by Cirrus's Pixel Semiconductor subsidiary in Plano, Tex., by mid-year. Fluent predicts that the cost of compression boards will drop by 75% by year's end. Other industry officials consider anything more than a 30% decline unlikely.

—Larry Marion

ing systems, "Columbus: Encounter, Discovery, and Beyond" and "Illuminated Books and Manuscripts," which IBM contends will capture the MTV generation. Each product occupies multiple CD-ROMS and laser discs, costs more than $2,000, and requires about $10,000 of hardware.

• **DEC** In contrast to IBM, DEC isn't messing with stand-alone multimedia. In October, it began showing a technically sophisticated networked multimedia approach that aims beyond just digitized input, to include telephone, voice, facsimile, color graphics, video, and traditional text prepared for large organizations. For example, DEC envisions that retailers might tie together 12 video kiosks throughout their store to a file server.

• **Tandy** Tandy is visibly supporting the MPC standard while developing and pushing its own systems to the home market. But price levels of $3,495 and up are a bit rich for home users. "We really expect that, through 1992, the majority of purchasers will be either people in the educational community or business people who need delivery vehicles for multimedia titles," notes Tandy's Ed Juge. Tandy predicts a three- to five-year ramp-up for the consumer multimedia PC market if developers produce hot titles.

• **Japanese computer vendors** Fujitsu, a member of the MPC Council, continues to enhance its FM Towns CD-ROM system in Japan, but at a November developers' conference, its U.S. team said it will be at least a year before the black Mac-like system is available here. In Japan, more than 250,000 units of a non-Windows version have been sold, and the company claims that a Windows version of FM Towns will be available in March.

Although a partner with Philips for CD-I, Sony also introduced its own CD-ROM product, DiscMan, a $549 portable CD-ROM player that allows the user to have access to a mini-keyboard and screen in order to run a foreign language dictionary while travelling in a foreign country.

While rumors about an impending multimedia product alliance between Sony and Apple are running rife throughout the industry, Sony officials are reportedly scaling back their short-term expectations about the multimedia market. Overall, "the Japanese are much more cautious," observes market researcher Mascioni, in comparison to their all-out war over VCRs in the late 1970s and early 1980s.

• **Video-game makers** A big unknown are the plans of Sega and powerhouse Japanese game maker Nintendo. A CD-ROM player from Nintendo is due in January, following Sega's CD-ROM add-on due in 1992 with a $349 price. □

Pick-and-place vendors battered by Germany's spending cuts

U.S. suppliers must offer top-notch service
to grab the few opportunities that remain in a cost-conscious market

By Barbara N. Berkman

Described just a year ago as Europe's economic powerhouse, Germany today seems more like a sputtering, wheezing engine. Annual economic growth rates have slid from about 3% last year to 1.5% or so, according to the Deutsche Bank, while short-term interest rates climbed from 8.75% to 9.3%. One result: plunging capital investment, which has defied U.S. equipment makers' best efforts to sell into Europe's biggest electronics market.

Germany has never been an easy market for U.S. suppliers, but the current recession—the first to touch the traditionally robust German electronics industry, according to a source at VDMA, the Munich-based trade group for Germany's equipment manufacturers—adds yet another twist to the somersaults U.S. producers already must perform for demanding German buyers. For equipment vendors, that means meeting exacting specifications, providing equipment that is fully compatible with existing production lines and computer systems, and offering impeccable customer service.

You needn't look further than the German pick-and-place market, the largest in Europe, for examples. German electronics producers bought some 450 units last year, that were valued at about $134 million, according to estimates by Siemens AG. Siemens predicts that volume sales will rise 10% this year to reach a market value of $236 million.

Among 70-odd vendors of pick-and-place machines, Siemens dominates the German market with a 55% share by units placed and a 70% share by value. The company's high-end machines typically run between $500,000 and $625,000. U.S. vendors include Dynapert in Beverly, Mass., Quad Systems Corp. in Horsham, Pa., and Universal Instruments Corp. in Crystal Lake, Ill. Other major players include Japan's Panasonic, which has about a 20% market share, Fuji, and Yamaha.

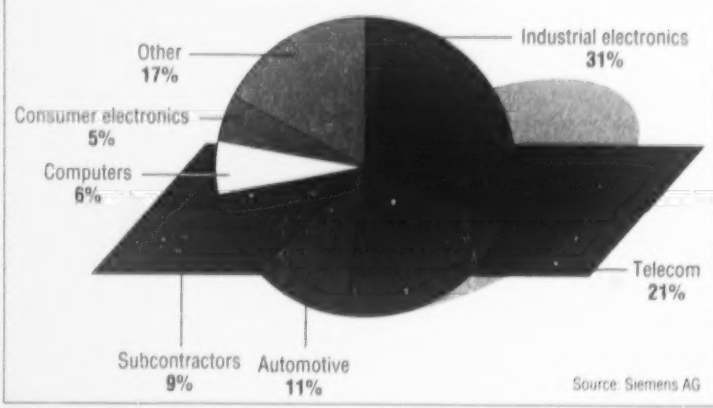
Most of those companies will find the German market especially tough sledding this year for at least three reasons:

- Many German customers will opt to use their machines 24 hours a day rather than buying more equipment, predicts Harald Bollen, Munich-based sales director of Siemens's automation group;
- The market is reaching the saturation point (especially among midsize companies) just as more aggressive players—including Panasonic—are charging onto the field. As a result, prices for entry-level machines could erode this year by as much as 20% from last year's range of $125,000 to $150,000;
- German buyers will exercise their well-known penchant for imposing strict demands for flexible component feeder capacity that allows quick changeover from one circuit board type to another.

Dynapert is moving along several fronts to boost its sagging German sales by 10%. The company underwent a restructuring move in 1991, added a vice president for

The German market for pick-and-place equipment

1990 end-use markets, % of total



Source: Siemens AG

Europe, and laid off 10% of its European work force when it shifted to a just-in-time delivery system. Dynapert also launched a service and spare-parts center in Frankfurt and launched a Europe-wide marketing, advertising, and direct-mail campaign touting its Intelliplace SMT range. "You must be strong in Germany to be strong in Europe," says Norman Hodson, market development manager in Colchester, England. Hodson predicts that the company's best-sellers in Germany will be a high-speed chip shooter, launched last November in Europe, and the I-318, newly revamped for European safety standards.

Quad Systems introduced a high-accuracy, medium-speed machine in 1991, called the 3C. Before that, "our products were targeted to the home market, not to Europe," admits marketing manager Kenneth W. Horton. In 1991 Quad enlisted Macrotron (UK) Ltd. in Swindon, England, as its European rep to peddle the compact machine, priced at $187,000 to $300,000.

PART OF QUAD'S strategy for servicing its German customers is to train Macrotron people in the United States. Horton concedes, however, that "there still will be a perception we'll be unable to support the machines." At best, he hopes Macrotron will sell 10 units in 1992 in Europe. Macrotron is targeting smaller German companies that aren't already SMT customers, says Kevin Barry, Macrotron's European sales and marketing manager.

Universal Instruments refers to its pick-and-place business in eastern Germany as "a little plus" in an otherwise flat German market; company sources claim more than 50% of the business in the region, with 1991 sales of about $9 million. "They can't pay cash, so we work out financing and leasing programs," says Dierk Muller, Universal's vice president of European operations in Bad Vilbel, Germany.

By running their machines during three shifts, German pick-and-place customers put extra pressure on vendors to provide fast local customer service. "Our philosophy is zero-hour—not 24-hour—service," says Holger Scheler, the manager of production engineering at Hagenuk in Kiel, Germany, a cordless phone maker and Siemens customer.

German customers use equipment nonstop rather than buying new, says Siemens's Harald Bollen

That's where many vendors typically run into trouble. Some German customers still nurse the perception that new non-German machines are incompatible with the vendor's older lines—one reason why customers such as Scheler favor Siemens. "Siemens is prepared to modify its existing lines to meet requirements of future technologies," he says. With Universal, he complains, "every year is a circus" because of incompatibility between new and existing equipment.

Not so, retorts Universal's Muller. He concedes that in the past the company offered new machines that weren't fully compatible with other Universal products, but it fixed the problem. Still, the image lingers. Its equipment is "not too impressive" and is fine "for through-hole, but not SMT," says pick-and-place customer Christian Scherf, business engineer with Robert Bosch GmbH. Universal pegs its share of the German market for through-hole machines at 60%.

The pressure clearly will be on suppliers to boost their customer-service presence this year, especially given the aggressiveness of Japanese companies. Panasonic opened a support center in Hamburg, hired 15 new German employees, and expects to hire 10 more in 1992. The company "wants to attack the competitors' customers," says Franz-Josef Hueske, Hamburg-based sales manager for Panasonic Factory Automation Deutschland. Business stolen from Siemens and other vendors accounted for about 10% of Panasonic's 1991 sales in Germany, and most of it was due to higher levels of customer service. Although Panasonic is well-established in high-end equipment, the company is now focusing on midrange machines priced from $187,000 to $375,000. "That is where we will meet Siemens," says Hueske.

For its part, Siemens is slashing production costs by moving functionality from hardware to software, sourcing more components from the Far East and the U.S., focusing on high-end special applications, and increasing sales to existing customers through upgrades.

Other European suppliers are having to settle for what amounts to table scraps. Technimount, a division of Fabrilec in Sint-Niklaas, Belgium, does a $5 million business in pick-and-place in Europe but has sold only three machines in Germany. President Hugo Michiels hopes to woo German customers with better service—installing modem connections from customers' machines to fault-analyzing computers in Brussels, for example.

Europlacer in Velizy, France, introduced a high-end $295,000 machine last June and projects German sales at 20 units in 1992, but so far it has sold only three. Those sales could give the company the much-needed endorsement to generate additional business. "Now we hope for a snowball effect," says product manager Christian Brozinski of Europlacer's German agent Peter Jordan GmbH in Offenbach, Germany.

That, of course, is what almost everyone is hoping for. "It's hard to sell the first system," says Macrotron's Barry, a lament that no doubt will be heard often this year from many U.S. equipment makers. □